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ABSTRACT

To ascertain the efficacy of a program of language and speech stimulation for the preschool cleft palate child, a research and demonstration project was conducted using 137 subjects (ages 18 to 72 months) with defects involving the soft palate. Their language and speech skills were matched with those of a noncleft peer group revealing that the cleft group was significantly inferior in receptive and expressive language skills. The program consisted of stimulation in which the mother participated with the child for 1 hour each week; during the period the clinician worked directly with the child, counseled the mother and directed her participation, and observed the mother in language and speech stimulation. The results of the program indicated significantly better progress by those involved in the program, compared to a control group, in both language skills and speech skills. By the end of the program the children involved had skills commensurate with their chronological age. Appendixes and extensive tables of results are included. (JM)

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FINAL REPORT

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A DEMONSTRATION PROJECT OF SPEECH TRAINING FOR THE PRESCHOOL CLEFT PALATE CHILD

Robert J. Harrison, Ph.D.
Audiology - Speech Pathology
University of Miami School of Medicine
Miami, Florida 33152

August 1969

Department of Health, Education, and Welfare

U.S. Office of Education
Bureau of Education for the Handicapped

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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I. SUMMARY

A research and demonstration project was conducted to study the efficacy of a program of language and speech stimulation for the preschool cleft palate child. Subjects were children between 18 and 72 months of age. The cleft palate children all had defects which, whether complete or incomplete, involved the soft palate.

First, the language and speech skills of these cleft palate children were compared with a noncleft peer group. It was found that the cleft palate children, regardless of age level, were significantly inferior to the normal children in both receptive and expressive language skills and speech skills. Even by five to six years of age few had gained the proficiency of the normal three-year-old.

A program of language and speech stimulation was developed in which the mother was involved as an active participant with the child. Activities were planned to teach the mother in methods of stimulating development of verbal communication skills and, when necessary, remediation was introduced. Each child was seen individually with his mother for one hour a week.

The progress of the cleft palate children who participated for 12 months in the program was statistically compared with control subjects who did not have any speech stimulation or remediation. The participants made significant progress superior to that of the nonparticipants in both language and speech skills.

The results of this project have shown conclusively that very young cleft palate children who have defects which involve the soft palate need assistance in development of verbal communication skills. The program which was conducted was clearly effective in promoting language and speech development.

II. INTRODUCTION

The few studies which have been made of the language and speech patterns of preschool cleft palate children, notably those of Bzoch (1956) and Morris (1960), indicate that delayed and defective patterns are likely occurrences. Eckelmann and Baldridge (1945), Hahn (1958) and Bzoch (1956) all discuss the need for early attention to the speech of cleft palate children. In practice, however, more attention is given to remediation than to prevention of delayed and incorrect language and speech patterns. This probably has been due, in part, to the immediacy of the physical problems which require attention and further to the difficulty encountered in observing and prognosticating language and speech development in the very young child.

Verbal communication, however, is not simply held in abeyance until the physical restoration is completed. The child, even though temporarily experiencing a period of physical incompetency, attempts verbal communication. Incorrect speech patterns may develop as the child tries to compensate for his physical inadequacy (Mulder, 1948). As Van Riper and Irwin (1958) point out, errors which become stabilized and reduced to automaticity are difficult to eliminate.

Moreover, delayed and defective verbal communication can be both educationally and socially handicapping (Johnson, et al., 1956). A pilot study of 50 school age cleft palate children seen at the South Florida Cleft Palate Clinic showed 48, or 96%, to evidence some speech problems and 23, or 46%, to be academically retarded one or more grades. The cause of retardation was not determined, but since all of the children had normal mental ability it was possible that delayed and defective verbal skills may have been a contributing factor. These 50 subjects had each received on the average 3.5 years of remedial speech services and most were still receiving such help. Cleft palate children do not constitute a large percentage of the case load of the public school clinician, but they do add to the burden of the clinician because they require remedial services for relatively long periods of time.

If a preschool program of language and speech stimulation could prevent or minimize problems encountered in development of verbal communication, it is possible that the number experiencing educational retardation would be fewer and that the amount of remedial services necessary during the school years could be substantially reduced.

The purpose of this project was to study the efficacy of early language and speech stimulation for the preschool cleft palate child. Specifically, the objectives were to 1)evaluate the need for language and speech stimulation, 2) develop a preschool program of language and speech stimulation, 3) evaluate the effectiveness of such a language and speech stimulation program, and 4) demonstrate the program procedures and results.

III. EVALUATION OF THE LANGUAGE AND SPEECH SKILLS OF PRESCHOOL CLEFT PALATE CHILDREN

The first objective of the project was to evaluate the verbal communication skills of the preschool cleft palate child. This was undertaken to provide a detailed and thorough exploration of the extent to which these children need a program of language and speech stimulation.

Where the papers relating to this section of the research have been accepted for publication these publications have been referenced. For these references only a summary of the findings are presented in this report.

Subjects

There were 137 children between the ages of 18 and 72 months in the experimental group. These children had clefts of either the lip and palate or the palate only, but all had clefts which involved the soft palate. In the control group there were 165 noncleft children between the ages of 30 and 72 months who were attending nursery and kindergarten programs located in the Metropolitan Dade County area. Normal subjects between the ages of 24 and 30 months were not available for this study.

Procedures

Tests administered for evaluation of language skills were as follows:

1. The Peabody Picture Vocabulary Test (Dunn,1965). This is a measure of comprehension of verbal language or, as Dunn calls it, "hearing vocabulary". For this test a raw score is obtained which then is converted to a"mental age".
2. The Verbal Language Development Scale (Mecham,1959). This scale is an extension of the Vineland Social Maturity Scale, and is administered by interview of the parent. It provides an evaluation of receptive and expressive language abilities. A raw score is obtained and then converted to a "language age".
3. The Language Ability Test (L.A.T.). This test was developed for the project by the staff. Test items were selected from the Kuhlman Binet (Kuhlman,1932), the Stanford-Binet, Form L and Form M (Terman and Merrill,1937), the Cattell (Cattell,1940), and Baker's Detroit Tests of Learning Aptitude (Baker and Leland, 1939) as measures of verbal comprehension and expression. These test items were chosen to obtain an objective measure of language behavior similar to that which is evaluated, somewhat subjectively, by the Mecham parent interview. There

were twelve test items for each age level, ranging from 1 to 5 years. They were placed at the particular age level established by the norms of the original tests. Each item was administered and scored as specified by the source directions. Receptive items (those arbitrarily judged to require the subject to comprehend but not express himself verbally) comprised 44% of the overall test and yielded a receptive language subtest score. Expressive items (those arbitrarily judged to require the subject to produce and use verbal language)comprised the remainder of the test and were used to determine an expressive language subtest score. These two subtests combined to give a Language Ability Total Score which was reported as a "language age".

Measures of articulation skills included the following:

1. An intelligibility rating. Intelligibility of the child's connected speech was rated by one of three speech clinicians prior to any evaluation of articulation skills. Phrases and sentences were elicited by asking the child questions about pictures in the book, Come Over To My House (LeSeig, 1966). This material was chosen because clinical experience indicated that it easily prompted spontaneous verbal responses. Intelligibility of the speech samples was rated on the following scale: (1) excellent - always intelligible; (2) good - usually intelligible; (3) fair - intelligible; (4) poor - partially intelligible; and (5) unsatisfactory - completely unintelligible.
2. Articulation test. Articulation was evaluated using a test in which the production of 24 consonant sounds in various positions and 33 consonant blends were assessed. Pictures representing each of the 100 test items were named for the child by the examiner. The child repeated each test word three times. Each error response was classified as an omission, which was considered the most severe error; or a substitution (including the glottal stop and the pharyngeal fricative); or an indistinct production (including distortion by nasal emission), which was considered the least severe error. The best production in the three attempts was recorded. This test was a modification of the Bzoch Error Pattern Articulation Test (Bzoch, unpublished).
3. The Miami Imitative Ability Test. Ability to imitate production of 24 consonant sounds when combined with a neutral vowel was determined by having the child "watch and listen" as the examiner repeated each consonant sound combined with a neutral vowel. After three productions of the sound by the examiner,

the child was then instructed, "Now you do it." The child's response was credited as one point if correct, one-half point if questionable, or zero if incorrect. Articulatory placement and acoustic production were scored separately for each sound. (Appendix A).

Other information collected on the cleft palate subjects included a) type of cleft, b) age at surgical closure of the palate, c) number of surgical procedures, d) number of siblings and e) rating of socio-economic status.

Audiometric screening determined hearing levels of all the subjects. Children in the control group were excluded if found to have a Hearing Level poorer than 20 decibels (ISO-1964) at any frequency in the 500-2000 Hz range of the better ear.

The Leiter International Performance Scale (Leiter, 1940) or the Merrill-Palmer (Stutsman, 1948) was used to measure nonverbal mental ability. Subjects were excluded if found to have intelligence quotients indicative of mental retardation (75 or below).

It was not possible to administer the complete test battery to all the subjects. For this reason, the number of subjects varies in relation to each test.

Results

Language Skills of Preschool Cleft Palate Children. (The Cleft Palate J., 6:2, 108-119, 1969).

Language abilities of 137 preschool cleft palate children were compared with those of 165 normal preschool children.

The cleft palate children were found to be retarded in both language comprehension and language usage. Retardation was demonstrated on each of the language measures when the scores of the cleft palate subjects were compared with their chronological age levels and, also, when compared with the scores of the noncleft control subjects. Although the language scores were progressively higher at each six-month-age interval, the scores were consistently lower than that of the appropriate chronological age. Additional data obtained from investigation of the vocabulary levels of the children 18 to 36 months also demonstrated delay in language acquisition.

It was concluded that the clearly demonstrated retardation in both receptive and expressive language skills for the preschool cleft palate children indicates a need for an early program of language stimulation.

Articulation Patterns of Preschool Cleft Palate Children.

(The Cleft Palate J., 6:3,245-253 , 1969).

The articulation skills of 74 cleft palate children 24 to 72 months of age were compared to those of 127 noncleft children of similar ages.

In terms of both articulation scores and intelligibility of connected speech, the cleft palate children were found to be inferior to the noncleft children. Although the cleft palate subjects improved at each age level, their performance always was poorer than that of the normal subjects. The extent of the difference between the two groups was underscored by the fact that the five- to six-year-old cleft palate children did not attain the intelligibility or the articulatory proficiency of even the three- to four-year-old control subjects. Furthermore, it was found that the cleft palate children, regardless of age level, never performed as well as the noncleft children in imitation of either articulatory placement or the acoustic production of speech sounds.

In addition to making a larger number of errors there were also obvious differences in the error patterns of the cleft palate and noncleft subjects. Although some of the errors might be attributed to velopharyngeal incompetency on the part of the cleft palate subjects, others reflected a general picture of retardation in speech development.

The findings led to the conclusion that preschool children who have defects which involve the soft palate need assistance in learning articulation skills if they are to achieve speech development commensurate with their potentials prior to entry into the primary school years.

Articulation Development of Preschool Cleft Palate Children.

The purpose of this section of the study was to compare the patterns of the articulatory development of the cleft palate children and normal children and to consider the procedural implications therein.

Subjects

The articulation test scores of 64 cleft palate and 127 noncleft subjects who were between 36 and 72 months of age were analyzed. All of these children had normal mental ability and none had received any remedial speech services. The cleft palate children had defects which, whether complete or incomplete, had involved the soft palate and each had undergone initial surgical repair of the soft palate.

Procedures

The subjects were divided into three groups representing the three-, four-, and five-year age levels. The articulatory proficiency of the cleft palate and noncleft subjects was compared by grouping the single consonant test items according to (1) phonetic classification of the sounds, (2) voicing, (3) position of the sound in the test word, and (4) type of error made. Percentages of errors were determined by dividing the number of errors made by the number of errors possible.

Results

Table 1 shows the percentage of errors for specific sound groups. Percentages are given for the cleft palate and noncleft subjects at the three-, four-, and five-year age levels. As can be seen, the order of difficulty was similar for both groups of children and showed little change with age level. Fricative and affricative sounds were the most difficult. Aspirants and nasals were the least difficult. This is consistent with information available on the normal developmental sequence for acquisition of specific consonant elements (Templin, 1957).

Of particular interest is the poor performance of the cleft palate subjects on glides, aspirants and nasals; sounds which should not be greatly affected by velopharyngeal inadequacy. Note, for example, that for the cleft palate subjects at the three-year level, 71% of the glides were in error compared with 30% for the noncleft subjects. Similarly, 44% of the aspirants were in error compared with 2% for the noncleft children and 38% of the nasal sounds were in error compared with 5% for the noncleft subjects. This is interpreted as indicative of a generalized delay in articulatory development. It is suggested that these aspirants, glides and nasal are sounds which should receive early attention in a speech stimulation program because, with the exception of the /r/ and /l/, children normally articulate these sounds correctly by 42 to 54 months of age. Another reason for early attention to these sounds is that it should be easier to stimulate their correct production because they are less dependent on adequate velopharyngeal valving than are fricatives and plosives. Furthermore, early development of successful production of these consonants might help to prevent some of the lingual maladaptations and articulatory confusions encountered in the speech of cleft palate individuals.

From the data presented in Table 2, articulatory proficiency and development can be studied in relation to voicing of consonant sounds. As before, the percentage of errors was determined by dividing the number of errors made by the number possible. Here, however, only cognate sounds were

TABLE 1. Percentage of errors in consonant sound productions classified by phonetic type.

Phonetic Type	Cleft Palate 3 yrs N=27	Cleft Palate 4 yrs N=16	Cleft Palate 5 yrs N=21	Noncleft 3 yrs N=25	Noncleft 4 yrs N=51	Noncleft 5 yrs N=51
Fricatives	98	83	73	49	35	28
Affricates	92	84	70	42	21	12
Glides	71	46	39	30	18	13
Plosives	70	43	31	6	2	2
Nasals	38	30	24	5	1	3
Aspirants	44	25	7	2	1	1

TABLE 2. Percentage of errors in consonant sound productions classified according to voicing.

Consonant Sound Classification	Cleft Palate 3 yrs N=27	Cleft Palate 4 yrs N=16	Cleft Palate 5 yrs N=21	Noncleft 3 yrs N=25	Noncleft 4yrs N=51	Noncleft 5 yrs N=51
Fricatives						
voiced	95	85	76	57	42	31
voiceless	97	82	70	41	27	25
Plosives						
voiced	69	42	31	7	2	2
voiceless	71	45	31	6	1	2
All consonants						
voiced	87	70	57	35	24	17
voiceless	86	68	56	29	17	15

considered. When all cognates, the fricatives, affricates and plosives were grouped together, both the cleft and noncleft subjects showed a slight tendency to make more errors on voiced sounds than on voiceless sounds. The opposite finding is usually reported for cleft palate subjects (Spriestersbach, 1968).

When voicing was related to phonetic grouping the noncleft children made more errors in production of voiced fricatives than voiceless, and nearly the same number of errors in production of voiced and voiceless plosives. Again this is consistent with information on the normal developmental sequence for acquisition of correct production of consonant elements.

The cleft palate children had a different pattern of development. As was shown in Table 1, there were so many errors on fricatives (73-98%, depending on the age level) that one could anticipate the resulting lack of difference between voiced and voiceless fricatives. On plosives sounds, where there were fewer errors, the cleft palate children showed a slight tendency to make more errors on voiceless sounds. It is possible that the greater proficiency with voiced sounds that is reported by other investigators becomes apparent only with maturation. This could be masked in this present study by the use of preschool subjects and by their delay in development of articulation skills. In view of this, it might be anticipated that cleft palate children may experience greater success in learning correct production of voiced consonant sounds.

Articulation errors were next viewed in relation to the position of the sound in the word. As can be seen in Table 3, the percentages of errors were highest for final sounds and lowest for initial sounds. While this was true for both cleft palate and noncleft children at all age levels, the differences between the initial and final sounds were more pronounced for the cleft palate children. Only the cleft palate children made more errors on medial sounds than on initial sounds. The implication of this finding is that the clinician, in planning a program of speech stimulation, should give consideration to the fact that initial sounds appear to be much easier for the cleft palate children than medial or final sounds.

For this study, each articulation error was classified and recorded as (1) an indistinct production, or (2) a substitution, or (3) an omission. Indistinct productions were considered the least severe error and omissions were considered the most severe error. The child's best production in three attempts was recorded. The recording method made it impossible to evaluate the consistency of the error pattern in the child's three attempts at production of a particular word. Clinical observation, however, indicated that the cleft palate children

TABLE 3. Percentage of errors in consonant sound productions classified by position of the sound.

Consonant Sound Position	Cleft Palate			Noncleft		
	3 yrs. N=27	4 yrs N=16	5 yrs N=21	3 yrs N=25	4 yrs N=51	5 yrs N=51
Initial	69	48	39	25	17	13
Medial	78	63	48	26	16	13
Final	84	68	59	31	25	15

TABLE 4. Percentage of errors in consonant sound productions classified as to type of error.

Type of Error	Cleft Palate			Noncleft		
	3 yrs N=27	4 yrs N=16	5 yrs N=21	3 yrs N=25	4 yrs N=51	5 yrs N=51
Indistinct production	17	16	16	4	4	4
Substitution	27	22	22	18	11	8
Omission	33	20	10	5	2	1

were much more inconsistent than the controls. This observation suggests that the consistency of production should be studied to determine possible diagnostic and clinical implications for cleft palate children.

Table 4 shows the percentage of errors in relation to the type of error made. As before, the percentages were determined by dividing the number of errors of a particular type by the number of errors possible. In this case, the number of errors possible was the total number of consonant productions evaluated. The noncleft subjects demonstrated decreasing percentages of errors of omission and substitution as age level increased. Errors classified as indistinct did not change with age level. The pattern for the cleft palate children was somewhat different. They evidenced a decrease in the percentages of errors of omission, but even at the five-year level were omitting sounds more frequently than the three-year-old control subjects. This comparatively high percentage of omissions is interpreted as additional evidence of generalized delay in articulation development. The percentages of errors of substitution decreased only slightly with age and the indistinct errors did not decrease. It is possible that the percentages of indistinct errors and substitutions remain high because omissions, instead of being corrected, are being changed to substitutions and indistinct productions.

It is suggested that the speech clinician first assist the child in production of sounds which are omitted and try to prevent a maturational shift of an omission to a substitution. To accomplish this it may be necessary to encourage those children who have inadequate velar mechanisms by rewarding correct articulatory placement for a sound even in the presence of distortion by nasal emission. Distortions in the articulatory patterns are preferable to substitutions or omissions which are more apt to decrease intelligibility.

Despite many similarities between cleft palate and noncleft children in the development of articulation skills there are patterns which distinguish the two groups. It is recognized that there are many factors which can influence the speech development of the cleft palate child. It is not possible from this study, however, to evaluate the degree to which various concomitants of cleft palate, such as velopharyngeal inadequacy and fluctuating hearing levels, influenced the speech development of these children. Apparently, however, nearly all of the children have abnormal speech due to the past or current operation of such factors. It is obvious from the data presented that children with defects of the soft palate were less proficient in articulation of consonant sounds than the noncleft children. This was true regardless of how these speech sounds were classified and regardless of the age level of the children. The clinician, in planning a program to stimulate articulatory development should give careful consideration to the error patterns which have been described and to their possible diagnostic and procedural implications.

IV. DEVELOPMENT OF A LANGUAGE AND SPEECH STIMULATION PROGRAM FOR PRESCHOOL CLEFT PALATE CHILDREN

A search of the literature has revealed, with the exception of the articles by Eckelmann and Baldridge (1945) and Hahn (1958), relatively little information regarding procedures to assist the preschool cleft palate child in development of language and speech skills. The procedures suggested by Eckelmann and Baldridge are more remedial than developmental. Hahn recommends parental assistance in development of verbal communication but defers recommendations for direct work with the child until three to five years of age. Textbooks on clinical procedures in speech pathology give little attention to specific methods for habilitation of the speech problems of the very young cleft palate child (Van Riper and Irwin, 1958, and Travis,et al., 1957). It was, therefore, necessary to develop and organize a program of language and speech stimulation for the preschool cleft palate child. This program provided a medium for evaluation of the efficacy of early stimulation of verbal communication for these children.

Purpose and Objectives

The program was planned for the preschool child who has a defect which involves the soft palate. Its purpose was to provide language and speech stimulation in order to promote the development of verbal communication skills to the maximum of each child's potential.

The specific objectives of the language and speech stimulation program were: 1) To allay parental anxiety concerning the child's development of language and speech skills; 2) To develop the child's confidence in his ability to achieve intelligible verbal communication; 3) To stimulate the development of speech and language skills commensurate with the child's ability; 4) To prevent or minimize the development of undesirable compensatory patterns when physical inadequacies interfere with the normal development of articulation skills.

Organization

Children were seen individually for one hour each week. The mother, or the person who served as the mother figure, attended each session with the child.

The hour-long sessions were usually divided into three sections: 1) the clinician worked directly with the child while the parent observed, 2) the clinician counseled the mother and directed her participation in the language and speech stimulation activities, and 3) the clinician observed as the mother assumed the responsibility for the language and speech stimulation.

These sessions provided opportunity for the child to become oriented to the program; the clinician to both direct and observe the child's responses; the parent to observe the clinician and the child, and the clinician to observe and direct the parent's participation.

Procedures

Three publications, prepared during the conduct of this project, describe the procedures for evaluation and stimulation of language and speech skills:

Language and Speech Stimulation for Preschool Cleft Palate Children.

(Motion Picture) Audiology-Speech Pathology, School of Medicine, University of Miami, 1969.

Procedures for Language and Speech Stimulation for Preschool Cleft Palate Children, Audiology-Speech Pathology, School of Medicine, University of Miami, 1969.

Philips, Betty J., In Cleft Lip and Palate (W.C. Grabb, S.W. Rosenstein, and K.R. Bzoch, editors), Chapter 47, Little Brown and Co.; Boston, Massachusetts: In Press.

V. EVALUATION OF THE LANGUAGE AND SPEECH STIMULATION PROGRAM

In order to determine the value of the language and speech stimulation program data were collected and analyzed on preschool cleft palate children participating in the program and on a control group who received no such program. The following section will detail the results of this investigation.

Subjects

The Florida Crippled Children's Commission, the South Florida Cleft Palate Clinic and individual plastic surgeons were notified of the demonstration program and asked to refer any cleft palate children who were between 18 and 72 months of age. It was requested that referrals be made regardless of the language and speech abilities of the children.

There were 97 children in the Miami area referred to the demonstration project as possible participants in the language and speech stimulation program. It was not possible to locate or contact 29 of these subjects. The remaining 68 were enrolled in the program. Data are reported for only those children who 1) had cleft which involved the soft palate, 2) had undergone initial surgical repair of the soft palate prior to any tests for re-evaluation, 3) were of normal mental ability as evaluated by a nonverbal measure,4) were Caucasian, 5) had received no previous language and speech stimulation, 6) were from homes where English was the spoken language, and 7) were enrolled in the language and speech stimulation program for at least 12 months. Use of these criteria to select the subjects for whom data are reported limited the number of experimental subjects to 20.

There were 97 children outside the Miami area who were evaluated as possible control subjects, because they could not participate in the demonstration program. These were all of the children under six years of age who were known to Florida Crippled Children's Commission as having had cleft palates and who could be contacted. The same criteria used to select the experimental subjects were used to select the control subjects. Rather than participation in the language and speech stimulation program, it was required that these subjects receive no such services. Use of these criteria limited the number of control subjects to 25.

The N's for both the experimental and control subjects are the number of comparisons made on each test at intervals of approximately 12 months between test-retest data.

Table 5 describes the subjects in terms of chronological age at the time of initial evaluation, sex, socio-economic level, and cleft type.

Procedures

The test battery which was administered for evaluation of language and speech skills was described on pages 3-4 of this report. In addition, the connected speech samples for each child were rated as to the degree to which the speech had characteristics commonly identified as cleft palate. A five point rating scale described the cleft palate quality as 1) none, 2) mild, 3) moderate, 4) severe, and 5) profound.

For this section of the study the ratings of intelligibility and cleft palate quality were made by the examining clinician or by one clinician who evaluated the taped connected speech sample.

Hearing was evaluated at the time of the annual testing. Two children who demonstrated a sensori-neural loss were excluded. Other than this, hearing levels were not used as a criteria for excluding or including subjects in the experimental or control groups. It was assumed that nearly all children who have palatal defects suffer episodes of otitis media and

TABLE 5. Characteristics of subjects.

		Experimental N=20	Control N=25
Chronological age at time of initial evaluation:	18-33 mos.	5	0
	24-29 mos.	2	2
	30-35 mos.	2	4
	36-41 mos.	5	3
	42-47 mos.	4	4
	48-53 mos.	1	4
	54-60 mos.	1	5
	61-72 mos.	0	3
Male		11	12
Female		9	13
Upper socioeconomic level[1]		5	1
Middle socioeconomic level		8	16
Lower socioeconomic level		7	8
Complete cleft of lip and palate		14	16
Incomplete cleft of palate only		6	9

[1] Socioeconomic level was rated on an eight point scale based on the parent's vocational occupation (NIMH,1965). These were grouped arbitrarily into upper,middle and lower levels. The upper socioeconomic level included ratings of one and two, professional and subprofessional workers; the middle socioeconomic level included ratings of three, four and five, the skilled and semi-skilled workers; and the lower socioeconomic levels included the ratings of seven and eight, the unskilled and unemployed.

concomitant reduction in hearing levels. The effects, therefore, of episodes of reduced hearing levels probably were operating for both the experimental and control groups.

Reliability

Coefficients of reliability are not reported for the language measures since these are discussed in the published manuals for each of these tests. (Donn, 1965, Mecham, 1959, Kuhlman, 1932, Baker, 1939, Terman and Merrill, 1937).

Information on the reliability of the speech measures,with the exception of the ratings of cleft palate quality and intelligibility, is given in the article on "Articulation Patterns" (Philips and Harrison, 1969).

The reliability of the ratings of intelligibility and cleft palate quality were evaluated by having two judges, who are experienced speech pathologists make a series of independent evaluations, which were compared with the reported ratings made by the clinicians. These two judges did not know whether the subjects were classified as experimental or control, or whether they were evaluating initial or retest data. In addition, five subjects were included who did not have cleft palate. The judges were told that there were both cleft palate and noncleft subjects in the sample.

In rating intelligibility, the two judges made 128 evaluations which could be compared with the reported ratings. Exact agreements with the reported rating occurred 63 times; a variation of one point from the reported rating occurred 54 times; a variation of two points occurred seven times and three points only four times. Using these judgments as criteria, it appears that the reported ratings are reliable.

In rating cleft palate quality, the two judges made 123 evaluations which could be compared with the reported ratings. Exact agreements occurred 45 times; a variation of one point occurred 37 times; a variation of two points occurred 28 times and three points 13 times. The reliability was much lower than that of the intelligibility ratings. It appeared that the judges had difficulty separating intelligibility from cleft palate quality. Moreover, the judges' criteria of cleft palate quality differed. This type of rating may have potential but probably should be used only with judges trained to specific criteria so that better interjudge agreement could be obtained.

Results

The number of subjects for whom data were available varied for each test. In addition, due to holidays and illnesses, there were also fluctuations in the retest intervals. The average retest intervals ranged from 10 to 12 months. The variation in number of subjects and retest intervals resulted, consequently, in variation in the mean chronological age of the subjects on each test. Table 6 provides a comparison of the chronological ages of the two groups of the subjects at the time of the initial test and at the time of the retest. It was found that although all of the subjects were preschool children, the experimental subjects were from 11 to 19 months younger than the controls, except on the L.A.T. where their ages were similar. It would be expected, therefore, that the control subjects had an advantage in development of language and speech skills.

Both language and speech development correlate positively with chronological age (Templin, 1957). Comparisons of the progress of the experimental and control subjects must be considered in relation to the information given in Table 6.

1. Evaluation of language skills

As shown in Table 7, the mean Mecham language age of the experimental subjects was 8.04 months below that of the controls on the initial test. When the second evaluation was made approximately 11 months later, the children participating in the language and speech stimulation program had gained 18.47 points as compared with a gain of 12.91 points for those not participating. The experimental subjects, who were 11 months younger than the controls, had earned on the second test a mean score nearly equal to that earned by the control subjects. It is important to remember that normally these language scores should be equivalent to the chronological age of the child. The mean score of the experimental group on the second test, however, was above the mean chronological age, 45.59 months, thus indicating excellent progress from the stimulation program. The mean score of the control subjects on the second test was approximately six months below their chronological age, 57.35 months.

When evaluating the results of the Language Ability Test, the subjects who were 54 months of age or older were excluded because their chronological age was within six months of the ceiling of the test. As can be seen in Table 6, on this test the experimental and control subjects were very nearly the same chronological age. On the initial test, the mean language age of the control subjects was slightly lower than that of experimental group (Table 7).

TABLE 6. Mean chronological ages of experimental and control subjects at time of initial evaluation and at time of re-evaluation.

	Experimental Subjects			Control Subjects		
Test	Initial test C.A.	Retest C.A.	Retest interval in mos.	Initial test C.A.	Retest C.A.	Retest interval in mos.
Mecham	34.00	45.59	11.59	45.83	57.35	11.52
Language Ability Test	33.21	44.79	11.58	35.85	46.85	11.00
Peabody	38.88	50.00	11.62	57.83	67.83	10.00
Imitative Ability	38.50	49.25	10.75	55.42	65.63	10.21
Articulation	38.50	50.56	12.06	54.23	64.42	10.19

TABLE 7. Comparisons of language skills of participants in the language and speech stimulation program with those of nonparticipants.

Test	Test 1 Experimental	Test 1 Control	Test 2 Experimental	Test 2 Control
Mecham				
N	17	23	17	23
M	30.53	38.57	49.00	51.48
SD	12.82	16.81	18.27	18.53
Language Ability				
N	14	13	14	13
M	29.43	23.08	42.86	34.15
SD	9.60	9.05	7.36	11.81
Peabody				
N	16	12	16	12
M	33.56	48.67	47.44	59.17
SD	9.40	19.84	11.40	21.93

When retested, the experimental subjects had gained 13.43 points (months) as compared with 11.07 points (months) for the controls. There was, therefore, a significant difference in the retest scores at the second test ($P < .05$). The control subjects were functioning below their chronological age of 46.85 while the experimental subjects were functioning close to their chronological age, 44.79 months.

The Peabody raw scores were also converted to a "mental age", and, therefore, had the scores been normal they would have been equivalent to chronological age. At the time of the initial test, the experimental subjects were 18.95 months younger than the controls and their mean Peabody score was 15.11 points below that of the controls. On retest it was found that the experimental group had gained 13.88 points and the control group 10.50 points. The mean scores of the two groups were significantly different ($P < .05$) at the initial test but not significantly different at the retest despite the 18 month chronological age gap in favor of the control group. The Peabody scores of the control subjects were 8.66 months below their mean chronological age while those of the children who participated in the program were 2.56 months below their mean chronological age.

In summary, the results of the language tests indicate that the children who participated in the language and speech stimulation program made greater gains on each of the three language tests than did the control subjects who did not have such a program. On these tests the control subjects earned retest scores six months or more below their chronological age. The experimental subjects, on the other hand, earned retest scores within three months, or better, than their chronological age indicating that, as a group, they had achieved normal language development.

2. Evaluation of speech skills

As seen in Table 8, out of a possible error score of 100, on the initial test the experimental group had a mean of 81.72 and the controls, 73.38. This is a nonsignificant difference of only 8.34 points despite the fact that the control subjects were 15.73 months older. When retested, the experimental subjects earned a mean error score of 48.78 which was significantly better than that of the control group mean of 66.19 ($P < .05$). The experimental subjects demonstrated a 32.94 gain compared to a 7.19 gain for the controls.

On both of the subtests of imitative ability, the best possible score was 24.00 points. The experimental subjects were inferior to the controls on these two tests at the time of the initial evaluation. At the time of the second test, however, the mean scores of the experimental group were slightly higher than the controls. The control subjects

TABLE 8. Comparisons of speech skills of participants in the language and speech stimulation program with those of nonparticipants.

	Test 1		Test 2	
Test	Experimental	Control	Experimental	Control
Articulation error score				
N	18	26	18	26
M	81.72	73.38	48.78	66.19
SD	14.80	24.84	26.76	27.45
Imitative ability consonant placement score				
N	16	24	16	24
M	11.25	14.21	18.28	16.17
SD	4.20	6.79	4.77	6.06
Imitative ability sound production score				
N	16	24	16	24
M	7.53	11.64	14.38	13.15
SD	3.45	6.88	6.11	7.05

were nearly 17 months older than the experimental subjects. The children who participated in the language and speech stimulation program had gained 7.03 points in the consonant placement and 6.85 points in the acoustic production score while the controls in the same period of time had gained only 1.96 and 1.51 points respectively.

As shown in Table 9, none of the 15 experimental subjects had an intelligibility rating of one or two on the initial test, but six attained this intelligibility level by the second test. Only three of 20 control subjects were at this level on the initial test, and only two improved to this level on the second test. Furthermore, only two of 13 control subjects improved their ratings, while seven of 14 experimental subjects rose above this level. These intelligibility ratings also indicate superior progress for the experimental subjects as compared to the controls. This, of course, reflects the improvement in articulation skills.

In addition, the data in Appendix B, page 79 , show that only seven of the experimental group had reached the age of five years or older. Six of these seven children received an intelligibility rating of one or two indicating that their speech was judged as always or usually intelligible. The remaining child had a rating of three indicating fair intelligibility. And, in Appendix B, page 76, it is seen that ten of the control subjects had reached the age of five years or older. Only two of these received an intelligibility rating of one; three, an intelligibility rating of three; and five were still at the four and five rating level.

Although the information on rating of cleft palate quality is given in Table 10, the results can not be given much emphasis because of the low reliability of these judgments. There was, however, more improvement among the experimental subjects than the controls, some of whom were judged to have regressed.

In summary, the results of each of the measures of speech skills indicated superior progress for those children who have participated in the language and speech stimulation program compared with those who did not.

VI. MATCHED CASE STUDIES

Due to the small number of control and experimental subjects, it was not feasible to utilize statistical techniques to evaluate the effect of the many variables which might influence progress in speech development.

Since the superior progress of the program participants was

TABLE 9. Comparisons of intelligibility levels of participants in a language and speech stimulation program with those of nonparticipants.

	Experimental (N=15)		Control (N=20)	
Rating	Test 1	Test 2	Test 1	Test 2
1 - 2	0	6	3	5
3	1	2	4	4
4 - 5	14	7	13	11

TABLE 10. Comparisons of ratings of the cleft palate quality of the speech of participants in the language and speech stimulation program with those of nonparticipants.

	Experimental (N=15)		Control (N=20)	
Rating	Test 1	Test 2	Test 1	Test 2
1 - 2	4	7	11	8
3	2	1	4	6
4 - 5	9	7	5	6

clearly demonstrated in the previous section, no additional statistical tests were necessary to compare the progress of the two groups. Individual case comparisons where many variables were matched, however, made possible clinical observations concerning the speech stimulation program.

Subjects

Nine of the 20 experimental subjects, those who participated in the language and speech stimulation program, were matched with 11 control subjects who did not participate or receive any form of remedial speech services. All the subjects who met the criteria for matching have been included. They were not selected to demonstrate particular observations. Since four of the experimental subjects matched with more than one control subject, 13 matched case studies were possible. There were 12 experimental subjects for whom no perfectly matched controls could be obtained, or for whom data were insufficient for this type of projection.

Procedures

The raw data on the initial speech tests and subsequent re-evaluations were listed for each experimental and each control subject with whom an exact match was possible on these variables: 1) chronological age (within six months), 2) type of cleft (complete cleft lip and palate or incomplete cleft of hard and soft palate), 3) age at initial closure of the palate (within six months), 4) race, 5) language, 6) socio-economic level (within 2 points on a seven point scale). All of the subjects had normal mental ability as determined by nonverbal measures of mental ability, and all were from large metropolitan communities. The subjects were similar in degree of severity of the speech problem at the time of the initial evaluation.

The reader is reminded of the following ranges of the test scores:

	Poorest Score	Best Score
Articulation Errors	100	0
Imitative Ability Scores		
Consonant Articulation Placement	0	24
Consonant Acoustic Production	0	24
Intelligibility Rating	5	1
Cleft Palate Quality Rating	5	1

Hearing levels were determined by pure-tone audiometric screening at 20 decibels (ISO-1964) at frequencies in the 500 to 2000 Hz range.

The observations which accompany each case history are based on the data presented and on clinical experience obtained in working with preschool cleft palate children in the speech stimulation program.

CASE STUDY 1.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 414 (female)	Control Subject 1101 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	51 weeks	0 weeks
test 3	83 weeks	0 weeks
Chronological age at		
test 1	49 months	53 months
test 2	62 months	64 months
test 3	74 months	74 months
Articulation errors		
test 1	78	97
test 2	38	87
test 3	14	91
Imitative ability-articulation placement		
test 1	12.5	--
test 2	23.0	8.0
test 3	--	10.0
Imitative ability-acoustic production		
test 1	7.5	--
test 2	19.0	4.0
test 3	--	10.0
Intelligibility rating		
test 1	4	5
test 2	3	5
test 3	1	5

CASE STUDY 1. (Continued)

Cleft type: Complete cleft of lip and palate

	Experimental Subject 414 (female)	Control Subject 1101 (female)
Cleft palate quality rating		
test 1	4	5
test 2	3	5
test 3	2	5
Audiometric screening		
test 1	failed	-
test 2	failed	failed
test 3	failed	passed

OBSERVATIONS

Both subjects had noticeably,defective speech at the time of the initial test. It is obvious that the experimental subject made much more improvement in language and speech development than the control subject who did not participate in the stimulation program. Observation of the chronological age at the time of the third tests shows that the control subject entered first grade with speech that was evaluated as being completely unintelligible. In contrast, the experimental subject achieved normal speech skills by 74 months of age.

CASE STUDY 2.

Cleft type: Complete cleft of lip and palate.

	Experimental Subject 421 (female)	Control Subject 1104 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	45 weeks	0 weeks
test 3	80 weeks	0 weeks
Chronological age at		
test 1	33 months	-
test 2	44 months	48 months
test 3	56 months	60 months
Articulation errors		
test 1	90	-
test 2	84	
test 3	55	88
Imitative ability - articulation placement		
test 1	12.0	-
test 2	16.0	10.0
test 3	16.0	10.0
Imitative ability - acoustic production		
test 1	6.0	-
test 2	11.0	9.5
test 3	11.0	10.0
Intelligibility rating		
test 1	5	-
test 2	4	5
test 3	3	4
Cleft palate quality rating		
test 1	5	-
test 2	4	5
test 3	3	5
Audiometric screening		
test 1	-	-
test 2	failed	passed
test 3	-	passed

CASE STUDY 2.

OBSERVATIONS

The experimental subject showed a steady gain in development of articulation skills. At 56 months of age she made 33 fewer articulation errors than the control subject.

The difference between the ability to imitate articulation placement and the acoustic production of consonant sounds suggested inadequate velopharyngeal closure for the experimental subject. It was prognosticated that there will be some improvement in articulation skills as articulation placement improves, but the amount of improvement will probably be limited by the velopharyngeal inadequacy. The language and speech program was continued for the experimental subject to encourage improvement to the maximum of the child's potential and to prevent acquisition of compensatory patterns.

CASE STUDY 3.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 421 (female)	Control Subject 509 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	45 weeks	0 weeks
test 3	80 weeks	0 weeks
Chronological age at		
test 1	34 months	-
test 2	44 months	42 months
test 3	56 months	54 months
Articulation errors		
test 1	90	-
test 2	84	78
test 3	55	45
Imitative ability - articulation placement		
test 1	12.0	-
test 2	16.0	14.0
test 3	16.0	18.0
Imitative ability - acoustic production		
test 1	6.0	-
test 2	11.0	12.0
test 3	11.0	18.0
Intelligibility rating		
test 1	5	-
test 2	4	4
test 3	3	3
Cleft palate quality rating		
test 1	5	-
test 2	4	4
test 3	3	3
Audiometric screening		
test 1	-	-
test 2	failed	failed
test 3	-	-

CASE STUDY 3.

OBSERVATIONS

Both the experimental and the control subjects evidenced improvement in speech skills, but neither achieved normal development by 54 months of age. As stated in the previous study, the plateau reached in imitative ability and the discrepancy in the articulation placement and acoustic production scores indicated velopharyngeal incompetency. Further surgical repair of the palate was indicated. Meanwhile, the speech stimulation program was continued to improve articulation placement and to prevent acquisition of incorrect compensatory patterns. The prognosis for the control subject was good for continued improvement in speech. Since his articulation score was below normal for his age, however, assistance in speech development was advised to assure maximum progress by six years of age, the time of entrance into the primary school years.

CASE STUDY 4.

Cleft type: Incomplete cleft of hard and soft palate

	Experimental Subject 419 (male)	Control Subject 1108 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	31 weeks	0 weeks
test 3	53 weeks	0 weeks
Chronological age at		
test 1	38 months	44 months
test 2	52 months	53 months
test 3	65 months	- months
Articulation errors		
test 1	74	87
test 2	28	80
test 3	0	-
Imitative ability - articulation placement		
test 1	18.0	14.0
test 2	22.0	15.0
test 3	24.0	-
Imitative ability - acoustic production		
test 1	11.5	13.0
test 2	20.5	13.0
test 3	24.0	-
Intelligibility rating		
test 1	4	5
test 2	3	5
test 3	1	-
Cleft palate quality rating		
test 1	4	5
test 2	3	5
test 3	1	-
Audiometric screening		
test 1	-	-
test 2	passed	passed
test 3	passed	-

CASE STUDY 4.

OBSERVATIONS

The experimental subject achieved nearly normal speech skills by 52 months of age, but the control subject had made only slight improvement. The minimal improvement in a nine month period and the severity of the problem suggested, in view of clinical experience, that this control subject will not make the spontaneous improvement evidenced by the control subject in Case Study 3. The difficulty evidenced in ability to imitate both articulation placement for speech sounds and the acoustic production indicated, by 44 months of age, a need for assistance in speech development. If tests were available at earlier age levels, it seems probable that this same indication would have been present.

CASE STUDY 5.

Cleft type: Incomplete cleft of hard and soft palate

	Experimental Subject 419 (male)	Control Subject 107 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	31 weeks	0 weeks
test 3	53 weeks	0 weeks
Chronological age at		
test 1	38 months	-
test 2	52 months	52 months
test 3	64 months	64 months
Articulation errors		
test 1	74	-
test 2	28	47
test 3	0	
Imitative ability - articulation placement		
test 1	18.0	
test 2	22.0	22.0
test 3	24.0	24.0
Imitative ability acoustic production		
test 1	11.5	-
test 2	20.5	20.0
test 3	24.0	24.0
Intelligibility rating		
test 1	4	-
test 2	3	2
test 3	1	1
Cleft palate quality rating		
test 1	4	-
test 2	3	2
test 3	1	1
Audiometric screening		
test 1	-	-
test 2	passed	passed
test 3	passed	-

CASE STUDY 5.

OBSERVATIONS

Both the experimental and the control subjects achieved normal speech skills by the age of 64 months. Clinical experience indicated that the prognosis for the experimental subject, particularly without stimulation, was questionable at the time of the initial evaluation because although the imitative ability scores were fair, there was a marked discrepancy between the two scores on the initial test.

CASE STUDY 6.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 422 (male)	Control Subject 107 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	42 weeks	0 weeks
test 3	73 weeks	0 weeks
Chronological age at		
test 1	45 months	-
test 2	56 months	61 months
test 3	68 months	73 months
Articulation errors		
test 1	94	-
test 2	79	54
test 3	69	50
Imitative ability - articulation placement		
test 1	12.0	-
test 2	14.0	22.0
test 3	15.0	21.0
Imitative ability - acoustic production		
test 1	7.0	-
test 2	5.0	17.5
test 3	13.0	15.0
Intelligibility rating		
test 1	5	-
test 2	4	3
test 3	4	3
Cleft palate quality rating		
test 1	5	-
test 2	4	3
test 3	4	3
Audiometric screening		
test 1	passed	-
test 2	failed	passed
test 3	passed	failed

CASE STUDY 6.

OBSERVATIONS

Neither the experimental nor the control subject achieved normal speech development by six years of age. Both needed remedial speech services at the time they entered first grade.

The experimental subject was making gradual improvement while the control subject showed little improvement. Ideally both should have had assistance in speech development beginning at 18 months of age.

CASE STUDY 7.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 423 (male)	Control Subject 512 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	35 weeks	0 weeks
test 3	64 weeks	0 weeks
Chronological age at		
test 1	56 months	61 months
test 2	68 months	73 months
test 3	79 months	-
Articulation errors		
test 1	43	54
test 2	35	50
test 3	0	-
Imitative ability - articulation placement		
test 1	19.0	22.0
test 2	22.0	21.0
test 3	24 0	-
Imitative ability - acoustic production		
test 1	13.0	17.5
test 2	18.0	15.0
test 3	24.0	-
Intelligibility rating		
test 1	3	3
test 2	1	3
test 3	1	-
Cleft palate quality rating		
test 1	3	3
test 2	2	3
test 3	1	-
Audiometric screening		
test 1	passed	passed
test 2	passed	failed
test 3	-	-

CASE STUDY 7.

OBSERVATIONS

Both children had reached six years of age and were entering first grade. The experimental subject had achieved normal speech. The control subject had defective speech patterns and connected speech was evaluated as sometimes difficult to understand. The Imitative Ability Scores suggested velopharyngeal incompetency for the control subject. In addition, the lack of improvement in a 12 month period suggested that the control subject needed remedial speech services.

CASE STUDY 8.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 411 (female)	Control Subject 1105 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	36 weeks	0 weeks
test 3	37 weeks	0 weeks
Chronological age at		
test 1	39 months	41 months
test 2	51 months	-
test 3	60 months	61 months
Articulation errors		
test 1	54	51
test 2	27	-
test 3	20	29
Imitative ability - articulation placement		
test 1	17.0	20.0
test 2	-	-
test 3	22.0	20.0
Imitative ability - acoustic production		
test 1	12.0	20.0
test 2	-	-
test 3	18.0	23.0
Intelligibility rating		
test 1	4	3
test 2	2	-
test 3	2	2
Cleft palate quality rating		
test 1	4	2
test 2	-	-
test 3	2	1
Audiometric screening		
test 1	passed	passed
test 2	passed	-
test 3	passed	passed

CASE STUDY 8.

OBSERVATIONS

The experimental and the control subjects demonstrated nearly the same speech level at 61 months of age. They were approaching normal level of development in articulation skills. The relatively good imitative ability of the control subject on the initial test prognosticated spontaneous improvement in articulation skills.

The poorer imitative ability of the experimental subject on the rated test indicated the needed assistance in speech development. Furthermore, the discrepancy in the ability to imitate articulation placement and the ability to imitate the acoustic production suggested velopharyngeal incompetency for the experimental subject.

Although the audiometric screening test was passed at the time of each of the annual evaluations, the experimental subject had repeated and severe ear infections. A T & A was performed subsequent to the third evaluation. Speech, following the T & A exhibited increased nasal emission. Further surgical repair of the palate was recommended. The speech stimulation program was continued to maintain the best possible speech levels and to prevent acquisition of compensatory articulation patterns.

CASE STUDY 9.

Cleft type: Incomplete cleft of hard and soft palate

	Experimental Subject 418 (male)	Control Subject 1110 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	46 weeks	0 weeks
test 3	86 weeks	0 weeks
Chronological age at		
test 1	43 months	48 months
test 2	55 months	57 months
test 3	67 months	-
Articulation errors		
test 1	96	73
test 2	74	84
test 3	18	-
Imitative ability - articulation placement		
test 1	6.5	18.0
test 2	11.0	14.0
test 3	23.0	-
Imitative ability - acoustic production		
test 1	5.0	11.0
test 2	8.0	7.0
test 3	23.0	-
Intelligibility rating		
test 1	5	4
test 2	4	5
test 3	2	-
Cleft palate quality rating		
test 1	4	4
test 2	4	5
test 3	1	-
Audiometric screening		
test 1	-	failed
test 2	passed	failed
test 3	passed	-

CASE STUDY 9.

OBSERVATIONS

The experimental subject showed continuous progress during a period of 24 months and achieved normal speech skills by 67 months of age.

The control subject was followed for only nine months. During this period, however, he made no progress, and, in fact, appeared to regress. It is possible that the hearing level was complicating his speech problems. Furthermore, the discrepancy in the imitative ability scores suggested velopharyngeal incompetency. These factors demonstrated a need for assistance in development of speech skills and a need for prevention of compensatory articulation skills.

The experimental subject passed the audiometric screening on the date of the annual evaluations. Longitudinal study indicated that he, too, had periodic ear infections which resulted in depressed hearing levels. When this occurred, however, he was immediately referred for otological management.

CASE STUDY 10.

Cleft type: Cleft of hard and soft palate

	Experimental Subject 418 (male)	Control Subject 218 (male)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	46 weeks	0 weeks
test 3	86 weeks	0 weeks
Chronological age at		
test 1	43 months	-
test 2	55 months	60 months
test 3	67 months	71 months
Articulation errors		
test 1	96	-
test 2	74	93
test 3	18	90
Imitative ability - articulation placement		
test 1	6.5	-
test 2	11.0	5.0
test 3	23.0	12.0
Imitative ability - acoustic production		
test 1	5.0	-
test 2	8.0	5.0
test 3	23.0	10.0
Intelligibility rating		
test 1	5	-
test 2	4	5
test 3	2	5
Cleft palate quality rating		
test 1	4	-
test 2	4	5
test 3	1	5
Audiometric screening		
test 1	-	failed
test 2	passed	failed
test 3	passed	-

CASE STUDY 10.

OBSERVATIONS

The experimental subject was approaching a normal level of development in articulation skills by 67 months of age, while the control subject showed relatively little improvement. The control subject reached school age with speech that was unintelligible. He should have had assistance at a much earlier age to prevent the development of incorrect compensatory patterns and to help him develop more acceptable speech before starting school.

CASE STUDY 11.

Cleft type: Incomplete cleft of hard and soft palate

	Experimental Subject 410 (female)	Control Subject 107 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	43 weeks	0 weeks
test 3	82 weeks	0 weeks
Chronological age at		
test 1	46 months	
test 2	58 months	52 months
test 3	70 months	64 months
Articulation errors		
test 1	90	-
test 2	62	47
test 3	55	
Imitative ability - articulation placement		
test 1	14.5	-
test 2	16.0	22.0
test 3	24.0	24.0
Imitative ability - acoustic production		
test 1	8.0	-
test 2	8.0	20.0
test 3	10.0	24.0
Intelligibility rating		
test 1	4	-
test 2	4	2
test 3	3	1
Cleft palate quality rating		
test 1	5	-
test 2	4	2
test 3	3	1
Audiometric screening		
test 1	-	-
test 2	failed	failed
test 3	passed	passed

CASE STUDY 11.

OBSERVATIONS

The control subject achieved normal speech by 64 months of age. The good imitative ability of the control subject at 52 months of age prognosticated good speech development.

The experimental subject evidenced steady improvement, but at 70 months of age the speech was still noticeably defective. The discrepancy in the imitative ability scores of the experimental subject represented velopharyngeal incompetency. Her improvement in imitation of correct articulatory placement was an indication that this child was close to achieving speech near the maximum of her potential. Compensatory articulation patterns were avoided. Study of the articulation errors revealed simple distortions by nasal emission. When surgical repair accomplishes adequate velar mechanism, speech should show a marked improvement.

CASE STUDY 12.

Cleft type: Incomplete cleft palate

	Experimental Subject 410 (female)	Control Subject 1108 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	43 weeks	0 weeks
test 3	82 weeks	0 weeks
Chronological age at		
test 1	46 months	44 months
test 2	58 months	53 months
test 3	70 months	-
Articulation errors		
test 1	90	87
test 2	62	80
test 3	55	-
Imitative ability - articulation placement		
test 1	14.5	14.0
test 2	16.0	15.0
test 3	24.0	-
Imitative ability - acoustic production		
test 1	8.0	13.0
test 2	8.0	13.0
test 3	10.0	-
Intelligibility rating		
test 1	4	5
test 2	4	5
test 3	4	-
Cleft palate quality rating		
test 1	5	5
test 2	4	5
test 3	3	-
Audiometric screening		
test 1	-	-
test 2	failed	passed
test 3	passed	-

CASE STUDY 12.

OBSERVATIONS

The experimental subject made steady progress but failed to gain normal speech skills by 70 months of age. As was shown in Case Study 11, the discrepancy in the two imitative ability scores indicated velopharyngeal incompetency.

This control subject made no real progress in the nine months which intervened between the first and second evaluation. At 53 months of age, speech was characterized by many articulation errors and evaluated as completely unintelligible. The imitative ability scores for this subject suggested adequate velopharyngeal closure. This child obviously needed assistance in development of speech skills.

CASE STUDY 13.

Cleft type: Complete cleft of lip and palate

	Experimental Subject 401 (male)	Control Subject 1002 (female)
Participation in speech stimulation program at		
test 1	0 weeks	0 weeks
test 2	53 weeks	0 weeks
test 3	-	0 weeks
Chronological age at		
test 1	37 months	36 months
test 2	49 months	47 months
test 3	-	-
Articulation errors		
test 1	97	95
test 2	83	75
test 3	-	-
Imitative ability - articulation placement		
test 1	4.0	3.0
test 2	11.0	9.0
test 3	-	-
Imitative ability - acoustic production		
test 1	2.0	3.5
test 2	6.0	9.0
test 3	-	-
Intelligibility rating		
test 1	5	5
test 2	4	5
test 3	-	-
Cleft palate quality rating		
test 1	5	5
test 2	5	5
test 3	-	-
Audiometric screening		
test 1	failed	-
test 2	passed	passed
test 3	-	-

CASE STUDY 13.

OBSERVATIONS

The control subject made a little more improvement than the experimental subject as measured by the decrease in the number of articulation errors. Both subjects, however, at four years of age had speech that was noticeably defective and difficult to understand. Both needed assistance in speech development.

The increasing difference between the imitative ability scores of the experimental subject suggests that there was velopharyngeal inadequacy. Despite this, he was improving his articulation. The control subject, as indicated by the imitative ability scores, appeared to have adequate velopharyngeal closure.

In summary, observations were made of the speech development of cleft palate subjects who were matched on a number of variables: chronological age, type of cleft, age at initial surgical repair of the palate, mental ability, race, language, socioeconomic level and severity of the speech disorder at the time of the initial evaluation. When these variables were held constant, it was observed that the program of speech stimulation was unquestionably effective in helping preschool cleft palate children develop speech skills.

These individual case studies demonstrate, as did the group statistical studies, that the experimental subjects who participated in the speech stimulation program made more progress in the development of speech skills than the control subjects who did not have this stimulation. Four of the nine experimental subjects achieved normal speech while only one of the eleven control subjects reached this desired level.

Velopharyngeal competency, of course, influenced the degree to which a subject could improve in speech skills. The case studies which detail the data for each subject made it possible to consider the effect of this variable on the progress of the subjects. The experimental subjects (401, 410, and 421) whose imitative ability scores suggested velopharyngeal incompetency demonstrated limited improvement in speech skills but did better than the control subjects (512 and 1110) whose test scores also suggested velopharyngeal incompetency.

Sex was a variable which was not a criteria for selection of subjects for the matched case studies. This did not appear to relate to the superior progress of those who participated in the language and speech program.

Hearing level was another variable which was not held constant. Observation of the case studies suggests that hearing level, as determined by annual audiometric screening tests, was not influencing the progress of the subjects. Participants in the speech stimulation program, however, were given audiometric evaluations each month and referred for otological evaluation and management when hearing levels indicated possible ear pathology. These children, therefore, were receiving prompt otological attention which may have assisted them in the development of verbal communication skills. One of the advantages of the speech stimulation program is the opportunity which is present for prompt detection and referral of otological problems.

In addition to these findings which provide an indication of the efficacy of early speech stimulation for the cleft palate child, the case studies are suggestive of the value of the Imitative Ability Test. This instrument appears to have potential for evaluating and prognosticating the speech development of the cleft palate child. Acoustic production scores which are poorer than articulation placement scores suggest possible velopharyngeal incompetency.

VII. CONCLUSIONS

Preschool cleft palate children who had defects which involved the soft palate were found to be retarded in both receptive and expressive language development. They were also found to have delayed and defective speech patterns. The cleft palate children at five to six years of age, despite normal mental ability, were not as proficient as three-year-old normal children. Delays in development of verbal communication were evidenced at the earliest ages at which these children were evaluated. For some this was as early as 18 months of age. It was concluded that these children needed and could profit from a program of language and speech stimulation initiated in infancy.

A research and demonstration program designed to stimulate development of verbal communication was conducted for 31 months for preschool cleft palate children. Participants were introduced into the program as early as possible; preferably, when they were 18 months old. The mother, or mother figure was an active participant and learned how to encourage language development and provide speech stimulation. In this way, one hour weekly sessions were extended by home stimulation.

Clinical observation indicated that the participants in the program made progress that brought language skills to a level commensurate with chronological age. Dramatic improvement in articulation skills and in intelligibility of speech was noted. When velopharyngeal incompetency or other physical problems were present the children and their mothers were taught to accept necessary distortions, e.g. nasal airflow, in production of speech sounds. It was observed that the children were able to learn correct articulation placement despite most physical inadequacies and thus, that incorrect compensatory patterns were minimized or avoided.

Comparison of test scores on various measures of communicative skills of participants in the program and nonparticipants confirmed the clinical impressions. The participants made excellent progress which was significantly superior to that of the nonparticipants. It was concluded, therefore, that this type of program for the very young cleft palate child provides effective assistance in overcoming delayed language and speech and in preventing acquisition of incorrect articulation patterns.

The Miami Imitative Ability Test which was developed for this project, and detailed study of the articulation patterns of these young cleft palate children provided valuable information for their speech clinicians. These data assisted the clinicians in prognosticating speech development and in planning the programs for individual children. Knowledge of the articulatory patterns of cleft palate children and measurement of their ability to imitate both articulation placement and the acoustic signal in production of consonants should be employed in planning individual programs of speech stimulation for these children.

The statistical data, while indicating the benefits of the program, was based on only 12-month test-retest evaluations. The clinical indications and limited retest data available for longer periods showed a continuation of significantly superior progress for the participants. If this study were extended it is suspected that the results would be similar, if not more favorable, for the experimental group. This project was not conducted within a team setting which probably would have enhanced the value and progress for the participants. Further study should be made to determine the relative benefits of a program initiated in infancy as opposed to those initiated at later ages. Obviously, time and cost would be important factors to consider and to weigh against emotional, social and educational benefits. Statistical information is not available to support the clinical impressions which indicated that prevention and reduction in compensatory articulation patterns was achieved. Although the individual clinical records support this,the conclusions need further documentation.

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APPENDIX A. Evaluation of the Imitative Ability of Cleft Palate Children.

Speech pathologists have long recognized that misarticulated sounds which can be instantaneously corrected upon visual and/or auditory stimulation are the sounds which will show the most spontaneous improvement (Carter and Buck, 1958; Farquhar, 1961; Snow and Milisen, 1954). Similarly, it has been reported that the ability to correctly imitate the production of a misarticulated sound in words and nonsense syllables indicates a good prognosis for speech training (Barnes and Morris, 1967; Sommers et al., 1967; Spriestersbach and Sherman, 1968). An adequate speech evaluation, then, should include some measure of this ability to correct a misarticulated sound after only a few integral stimulations. Milisen (1954) assigned the term "stimulability test" to instruments he used to measure this effect and even more recently, McDonald (1964) considered stimulability in the development of his _Deep Test of Articulation_.

Historically, tests of stimulability have been concerned with assessment of the sound as it is auditorily perceived by the examiner. There has been little or no attention to evaluating the child's ability to imitate the correct articulatory placement that is needed for production of the sound. In cases of functional articulation disorders, the articulatory placement of the sound usually is assumed to be correct when the sound is auditorily perceived as correct. Conversely, when a sound is auditorily perceived as incorrect, the articulatory placement of the sound will, in all probability, be incorrect. Such an assumption does not necessarily hold true for all articulatory problems, particularly for those of an organic origin. Cleft palate speakers, for example, may have correct articulatory placement for specific sounds, but the acoustic production may be incorrect due to nasal emission resulting from velopharyngeal inadequacy. In such cases, with the typical test of stimulability, these productions would be classified as incorrect, when in fact, there is correct articulatory placement.

On the other hand, some cleft palate speakers, with adequate velopharyngeal mechanisms, have been diagnosed as having atypical and inappropriate articulatory movements (Bzoch, 1964; Koepp-Baker, 1957; VanDemark and VanDemark, 1967). Misarticulations, such as glottal stops and pharyngeal fricatives, are usually learned by the child in an effort to compensate for the inability to impound oral pressure. These misarticulations are frequently retained even after velopharyngeal adequacy is achieved by surgical management (Bzoch, 1965; Morley, 1967). It has been observed clinically that many of these children will actually avoid correct articulatory placement in their compensatory efforts to prevent the occurrence of nasal emission. In this vein, Koepp-Baker (1957) noted that there was little doubt that mode and manner of tongue use in cleft palate speakers were basically variant and affected practically all articulations. It appears clinically important, therefore, to assess not only correct sound imitations of cleft palate speakers in the usual manner, but also to evaluate the ability to imitate the articulatory placement of sounds.

The Miami Imitative Ability Test was developed to assess both the ability to imitate the articulatory placement of consonant sounds, i.e., the correct lingual and labial movements required for sound production, and the ability to imitate the acoustic production of consonant sounds, i.e., the production of a sound which is auditorily acceptable by the examiner.

The present study was designed to investigate these imitative abilities in cleft palate and noncleft children. Specifically, the following questions were asked: (1) Do children show a difference between the ability to imitate the articulatory placement and the ability to imitate the acoustic production of consonant sounds? (2) Do cleft palate children differ from noncleft children in their ability to imitate the articulatory placement and the acoustic production of consonant sounds? (3) Is the ability to imitate the articulatory placement of consonant sounds a predictor of articulation errors? (4) Can improvement in articulation skills be prognosticated from the ability to imitate the articulatory placement of consonant sounds? and (5) Does assessment of the ability to imitate articulatory placement offer suggestions for remediation?

Subjects

Subjects for this study included 129 cleft palate children and 154 noncleft children ranging in age from 30 to 72 months. All of the subjects had normal intelligence as determined by nonverbal tests of mental ability. In addition, there were no known histories of birth injury. None of the children had received remedial speech services prior to initial testing.

The cleft palate subjects were participating in a larger project designed to demonstrate the efficacy of speech and language stimulation for preschool cleft palate children. They had clefts of either the lip and palate or the palate only, but all clefts involved the soft palate. Although normal hearing by bone-conduction was a criterion for selection of the cleft palate subjects, the investigators were aware that most of these preschool children evidence fluctuating and intermittent conductive hearing losses (Hayes, 1965; Paradise and Bluestone, 1968). For this reason, normal hearing by air-conduction was precluded as a selective criterion.

Noncleft subjects were obtained from nursery and kindergarten programs located in a large metropolitan community. These subjects had no visible defects of the oral mechanism. Hearing levels were within normal limits as verified by audiometric screening at a 20 dB Hearing Level (ISO-1964) in the 500-2000 Hz range.

Procedures

The *Miami Imitative Ability Test* was administered to evaluate each child's ability to imitate 24 consonant sounds. Consonant sounds were presented in CV productions using the neutral vowel sound /ʌ/. Because a pilot study, involving 10 cleft palate children, indicated that production of these sounds remains consistent in the initial, medial or final positions of syllables, each consonant was assessed only in the initial position. The child was instructed to, "Watch and listen" as the examiner repeated each syllable three times to provide adequate opportunity for the child to observe. After these stimulations the child was then instructed, "Now you do it." The ability to imitate both the articulatory placement and the acoustic production was evaluated for each sound. The articulatory placement and the acoustic production were scored separately and each could range from 0 to 24. The response was assigned a credit of one point if correct, one-half point if questionable, or zero if incorrect.

Since it was recognized that the visibility of consonant sounds could effect the scoring of articulatory placement, three experienced speech clinicians independently selected the 11 sounds in which articulatory placement was considered visible. There was unanimous agreement that of the 24 consonants tested, the visible ones were /p/, /b/, /t/, /d/, /f/, /v/, /θ/, /ð/, /l/, /m/, and /n/. For visible sounds, placement was scored by direct observation of the articulators. In those instances in which articulatory placement was not clearly visible, it was necessary for the examiner to judge the articulatory placement on limited visual assessment supplemented by the acoustic production. It was found that the percentage of errors made on the 11 visible sounds was a good predictor of the percentage of errors in all 24 consonant sounds. This relationship in the cleft palate subjects may be explained by the grossness of errors frequently exhibited, i.e. an obvious lack of lingual and labial movement. These errors occur often enough and are so apparent that the visibility of the particular sound does not seem to contribute greatly in judging the articulatory placement. For the noncleft subjects, however, this relationship supports the previously discussed assumption that when the articulatory placement of a sound is correct, the acoustic production of the sound will usually be correct. With these subjects, then, it appears that articulatory placement can be judged, by inference, from the acoustic production.

A 67-item picture articulation test was administered in which the same 24 consonant sounds were evaluated in various positions of word productions. Sixty-seven colored picture cards representing each of the test items were shown to and named for the child by the examiner. The child repeated each test word three times after the examiner, and the best production of the three attempts was recorded. Errors, from most severe to least severe, were classified as omissions, substitutions (including glottal stops and pharyngeal fricatives), or indistinct productions (including nasal emission accompanying an attempt at production). Nasal emission was classified as a substitution if it was used in place of the production of a sound. This test was readministered to some of the cleft palate subjects after a period of approximately twelve months. Of the 41 cleft palate subjects who were available for retests, 24 received 12 months of language and speech stimulation and 17 received no remedial services. The cleft palate subjects, therefore, were divided into a stimulation and a no-stimulation group.

Reliability

Three experienced speech pathologists administered the articulation tests and the imitative tests of articulatory placement and acoustic production. Examiner reliability was determined by interjudge correlations based on independent retests of 17 randomly selected subjects. Examiner reliability, evaluated in this fashion, was considered satisfactory. The coefficients of reliability were .93 for the articulation error scores, .64 for the imitated articulatory placement scores, and .76 for the imitated acoustic production scores. The lower coefficients of reliability for the imitative tests probably reflect the smaller range of scoring potential (24 points) as compared with the 100-point range possible on the articulation test.

Results

Imitative ability. Table 1 compares the mean scores for the imitation of the articulatory placement and imitation of the acoustic production of 24 consonant sounds for cleft palate and noncleft subjects. The reader will recall that the best possible score for the articulatory placement and acoustic production was 24.0 each. The mean articulatory placement scores were 14.82 and 21.88 for cleft palate and noncleft subjects, respectively, whereas the mean acoustic production scores were 12.39 and 20.89 for these same groups. Comparison of these data show the scores for articulatory placement were slightly higher (better) than the scores for the acoustic productions, regardless of age level and regardless of the presence or absence of a cleft. As might be expected, both the articulatory placement and the acoustic production scores were lower (poorer) for the cleft palate subjects than for the noncleft subjects. The cleft palate subjects were found to be significantly inferior to their noncleft peers both in the ability

APPENDIX A.

TABLE 1. Mean imitative ability scores for articulatory placement and acoustic production on 24 initial consonant sounds.

Age		Cleft Palate			Noncleft	
In Months	N	Placement	Acoustic	N	Placement	Acoustic
30-36	20	10.12	8.05	7	20.64	19.71
37-42	16	13.19	10.97	14	20.54	19.46
43-48	20	12.95	9.82	20	20.37	19.35
49-54	17	16.82	14.70	28	22.32	21.37
55-60	20	14.52	11.67	25	21.66	21.22
61-66	14	17.96	15.21	35	22.26	21.33
67-72	22	18.68	16.77	25	22.36	21.78
Totals	129	14.82	12.39	154	21.88	20.89

to imitate the articulatory placement (P=.001) and in the ability to imitate the acoustic productions (P=.001). The noncleft subjects approached mastery of the ability to imitate both the articulatory placement and the acoustic production by 30 months of age and were superior to the cleft palate subjects even at the 72-month age level.

Articulation and imitative ability. Correlations were obtained between the articulation error scores and (a) imitative articulatory placement scores, and (b) imitative acoustic production scores. For cleft palate subjects, the coefficients of correlation were .86 between articulation and placement scores and .89 between articulation and acoustic production scores. For noncleft subjects, the coefficients of correlation were .78 and .77, respectively. These correlations show that there was a high relationship between the articulation errors in word productions and the ability to imitate a sound production. This relationship also held for the ability to imitate the articulatory placement for the sound.

Table 2 gives the percentage of articulation errors in word productions involving sounds in which the articulatory placement was correctly imitated. For all of these sounds, the acoustic production was incorrect in the imitative ability test. For this analysis, 20 consonants which occur in all three positions of the test words were used. Inspection of Table 2 clearly shows that the noncleft subjects made fewer errors than the cleft palate subjects in these work productions. For those sounds in which cleft palate subjects could accurately imitate the articulatory placement, there were still high percentages of errors when these sounds were utilized in word productions.

Table 3 shows the percentage of misarticulated sounds in which the articulatory placement was correctly imitated by cleft palate subjects at the initial testing. This table also shows the percentage of these same misarticulated sounds which were corrected in word productions approximately 12 months later at the time of retesting. It can be seen that the group which received language and speech stimulation corrected a higher percentage of these sounds than the group which received no remedial services. In the former group, 63% of the initial consonants were corrected whereas only 47% were corrected in the latter group.

Table 4,on the other hand, shows the percentage of sounds in which articulatory placement was incorrectly imitated on the initial testing, and the percentage of these same sounds which were corrected in word productions after approximately 12 months. This table also indicates that the stimulation group corrected a higher percentage of their misarticulated sounds than did the no-stimulation group. It can be seen, by comparison of Tables 3 and 4, that those consonant sounds which show

APPENDIX A.

TABLE 2. Percentage of acoustic errors in word productions of 20 consonant sounds on which articulatory placement was imitated correctly in CV productions.

	Percentage of Errors in Word Productions Initial	 Medial	 Final
Cleft Palate N=118	79	82	87
Noncleft N=154	34	33	37

TABLE 3. Percentage of sounds cleft palate children corrected in word productions in which articulatory placement was correctly imitated in CV productions

	Initial Test Percentage of Sounds with Placement Correctly Imitated *	12-month Retest Percentage of Sounds Corrected in Word Productions Initial	 Medial	 Final
Stimulation N= 24	12	63	55	63
No-Stimulation N= 17	10	47	44	47

* Acoustic production was incorrect for these sounds.

APPENDIX A.

TABLE 4. Percentage of sounds cleft palate children corrected in word productions in which articulatory placement was incorrectly imitated in CV productions.

	Initial Test	12-month Retest		
	Percentage of Sounds with Placement Incorrectly Imitated*	Percentage of Sounds Corrected in Word Productions		
		Initial	Medial	Final
Stimulation N=24	38	37	33	38
No-Stimulation N=17	41	17	15	17

* Acoustic production was incorrect for these sounds.

the most improvement in word productions are those for which articulatory placement was correctly achieved at the initial evaluation. This generalization was true for both the stimulation and the no-stimulation groups. It also can be seen that stimulation of speech and language development resulted in a higher percentage of sounds corrected regardless of whether or not the articulatory placement was correct at the initial testing.

Discussion

This study showed that there was a difference between the ability to imitate the articulatory placement and the acoustic production of consonant sounds. The scores for imitation of articulatory placement were always better than the scores for imitation of the acoustic production for both cleft palate and noncleft subjects. These data suggest that in the sequential development of articulatory skills, articulatory placement is learned prior to the achievement of the correct acoustic production of a particular sound. It would be interesting to give further study to this aspect of speech development.

As might be expected, the cleft palate subjects were found to be significantly inferior to the noncleft subjects both in ability to imitate the articulatory placement and the acoustic production of consonant sounds. The cleft palate children in this study even by the age of 72 months did not gain the proficiency in these imitative skills of the 30-month-old noncleft child. The results of this study also show that the ability to imitate either the articulatory placement or the acoustic production of consonant sounds predicts articulation errors for both cleft palate and noncleft subjects. The high correlations between articulation errors and both articulatory placement and acoustic production scores suggest that a stimulability test that focuses on imitative ability may have utility as a screening test for articulation skills. Even though correlations were high between articulation errors and articulatory placement scores, some caution may be necessary in predicting articulation ability from only the articulatory placement ability of cleft palate children. As seen in Table 2, cleft palate subjects had a high percentage of articulation errors in words even when the articulatory placement for these sounds was imitated correctly in CV productions. This suggests that many of these children who achieve correct articulatory placement may exhibit velopharyngeal inadequacy causing the acoustic production of a sound to be distorted by nasal emission. For cleft palate children, therefore, it appears that both imitative scores are necessary in predicting articulation errors rather than using the articulatory placement ability alone. The data from the present study affirmatively supports the proposition that, for cleft palate subjects, improvement in articulation skills can be prognosticated from the ability to imitate the articulatory placement of consonant sounds. More improvement in articulation ability occurred for those sounds in which articulatory placement was correctly imitated than for those in which articulatory placement was incorrectly imitated.

The authors concluded that assessing the ability to imitate the articulatory placement of consonant sounds offers positive suggestions for remediation. Subjects in both the stimulation and no-stimulation groups who could correctly imitate placement made more improvement in articulation than those who could not perform this task. Since the stimulation group made more improvement than the group without stimulation, it appears that both maturation and stimulation accounted for improvement. Stimulation procedures, quite naturally, included some emphasis on placement of consonant sounds, but these sounds were not selected on the basis of the test of imitative ability. If sounds in which these children could imitate placement had been selected for stimulation, these sounds probably would have shown even more improvement over the 12-month period. Others have also suggested that articulatory retraining should begin with those defective sounds which can be imitated correctly since these are the sounds which the subject can correct most easily (Powers, 1957). These suggestions are supported by the beliefs of learning theorists that the repetition of a successful response will cause that response to acquire habit strength, whereas repeated failures will lead to the extinction of that response (Travers, 1967). It is suggested by the authors that the assessment of imitative ability, especially of articulatory placement, should be included in the evaluation of cleft palate children's speech. Such assessment has not only diagnostic importance but prognostic and remedial implications as well. It is further suggested that a stimulation program that emphasizes the articulatory placement of consonant sounds is necessary for cleft palate children in helping them overcome lingual maladaptations and compensations. It is possible that a program that focuses on the acoustic production of sounds will interfere with progress for the cleft palate child who has not developed velopharyngeal adequacy because even though he is achieving correct placement, the sound he hears can be distorted by nasal emission and, therefore, will not be compatible with the sound produced by the clinician. Emphasis on placement rather than the acoustic production may be a more realistic goal for such a child.

Summary

One hundred twenty-nine cleft palate children and 154 noncleft children between the ages of 30 and 72 months were given the Miami Imitative Ability Test, a test of ability to imitate consonant sounds in CV productions, and an articulation test of sounds in word productions. It was the purpose of this study to assess the imitative ability for both the articulatory placement and the acoustic production of consonant sounds. Articulation tests were readministered after a period of 12 months to a portion of the cleft palate children, 24 of whom received language and speech stimulation, and 17 of whom received no stimulation.

The results of this study showed that: (1) the imitation of the articulatory placement was always better than the imitation of the acoustic production of consonant sounds for both cleft palate and noncleft subjects, (2) the cleft palate subjects were significantly inferior to the noncleft subjects in imitation of both the articulatory placement and the acoustic production, (3) the ability to imitate either the articulatory placement or the acoustic production in CV productions predicts articulation errors in word production for both cleft palate and noncleft subjects, (4) for cleft palate subjects, improvement in articulation skills can be prognosticated from the ability to imitate the articulatory placement, and(5) assessment of the ability to imitate articulatory placement offers suggestions for remediation.

It is suggested that the *Miami Imitative Ability Test* be used as a screening test of articulation skills, that assessment of the imitative ability of cleft palate children has diagnostic, prognostic and remedial implications, and that a stimulation program emphasizing the articulatory placement of consonant sounds is necessary for cleft palate children in providing optimum assistance in overcoming lingual maladaptations and compensations.

APPENDIX A.

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APPENDIX A.

MIAMI IMITATIVE ABILITY TEST

Name________________________ Date________________________

	Articulatory Placement	Acoustic Production	Observations
p			
b			
t			
d			
k			
g			
f			
v			
θ			
ð			
s			
z			
ʃ			
ʒ			
tʃ			
dʒ			
h			
w			
j			
r			
l			
m			
n			
ŋ			

Score ________________________

APPENDIX A. MIAMI IMITATIVE ABILITY TEST

DIRECTIONS FOR ADMINISTRATION

Procedure

Seat child at a table facing the examiner.
Instruct child: "Watch! Listen!"
Repeat sound three times to give child opportunity to observe.
Consonants are presented with the neutral vowel sound /ʌ/.
Instruct child: "Now you do it!"

Scoring

Record child's first response and score the articulatory placement and the acoustic production separately as:

1 = Correct ½ = Questionable 0 = Incorrect

Criteria for Articulatory Placement

The measure of articulatory placement is a gross assessment of the child's ability to attempt the correct lingual and labial movements required for sound production. If it is difficult to directly observe the articulators, placement may be scored by inference from the acoustic production. Gross lingual and labial movements and no responses are scored as incorrect and should be noted in the Observations column on the test form.

Criteria for correct articulatory placement

p,b	lips approximated then released
t,d	elevate tip of tongue to contact alveolar ridge behind upper incisors
k,g	dorsum of tongue elevated to make contact with palate
f,v	lower lip contacts upper incisors
θ,ð	tongue tip elevated and protruded so that inferior surface rests on lower incisors and tip of dorsal surface contacts upper incisors
s,z	tip of tongue elevated and drawn forward to contact alveolar ridge behind upper incisors, or tongue tip behind lower incisors with forepart of tongue drawn forward to contact alveolar ridge behind upper incisors
ʃ,ʒ	tip of tongue elevated and drawn forward just

	posterior to alveolar ridge; lips protruded slightly
tʃ, dʒ	tongue tip elevated to anterior hard palate then depressed suddenly; lips are protruded
h	tongue in position for neutral vowel /ʌ/; lips open
w	high back tongue position; lips rounded
j	anterior dorsal surface of tongue is raised toward hard palate
r	tongue tip lowered and central section raised toward hard palate with lips slightly protruded, or tongue tip elevated and curled slightly toward hard palate with lips slightly protruded
l	tongue tip elevated to contact alveolar ridge behind upper incisors, or tongue tip behind lower incisors with forepart of tongue pushed forward to make contact behind upper incisors
m	lips approximated during production of the sound
n	tongue tip elevated to alveolar ridge behind incisors and maintained in this position during the production of the sound
ŋ	dorsum of tongue elevated to make contact with palate

Criteria for Acoustic Production

Any response which would be perceived as acceptable on a test of articulation is scored as a correct acoustic production. Sound substitution, nasal emission and no responses are scored as incorrect and should be noted in the Observations column on the test form.

APPENDIX B Results of various measures of the language and speech of experimental and control subjects.

TABLE 1. Scores of control subjects on measures of language skills.

Subject	Language Ability Test				Mecham Verbal		Lang.Dev.Scale		Peabody Picture Voc. Test			
Number	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2
106	40	51	35	50	40	51	40	66	40	51	29	49
107	-	-	-	-	52	64	52	63	-	-	-	-
108	-	-	-	-	69	82	54	75	-	-	-	-
109	42	54	33	51	42	54	41	69	42	54	34	45
208	-	-	-	-	43	55	21	35	55	63	25	33
218	-	-	-	-	60	71	40	35	60	71	32	35
218B	-	-	-	-	-	-	-	-	71	80	35	35
220	-	-	-	-	60	71	56	60	60	71	53	62
225	44	53	26	37	44	53	33	40	-	-	-	-
304	24	37	15	23	24	37	21	29	-	-	-	-
304B	37	45	23	38	-	-	-	-	-	-	-	-
509	42	54	40	54	42	54	56	73	-	-	-	-
512	-	-	-	-	61	73	58	69	61	73	59	67
515	33	45	14	17	33	45	17	27	-	-	-	-
601	26	38	15	26	26	38	16	35	-	-	-	-

APPENDIX B

TABLE 1 (Continued). Scores of control subjects on measures of language skills.

Subject	Language Ability Test				Mecham Verbal Lang. Dev.Scale				Peabody Picture Voc.Test			
Number	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2
601B	38	47	26	33	-	-	-	-	-	-	-	-
603	-	-	-	-	34	46	33	52	-	-	-	-
606	-	-	-	-	60	73	66	66	60	73	59	82
606B	-	-	-	-	-	-	-	-	73	81	82	99
609	-	-	-	-	67	75	66	93	67	75	82	85
610	-	-	-	-	-	-	-	-	57	65	58	71
703	30	42	17	32	30	42	17	30	-	-	-	-
1002	36	47	28	36	36	47	36	43	-	-	-	-
1101	-	-	-	-	53	65	36	46	-	-	-	-
1103	-	-	-	-	56	67	58	66	-	-	-	-
1104	-	-	-	-	48	60	25	46	-	-	-	-
1107	41	52	14	23	41	52	16	29	-	-	-	-
1108	33	44	14	24	33	44	29	37	-	-	-	-
1110	-	-	-	-	-	-	-	-	48	57	36	47

APPENDIX B

TABLE 2. Scores of control subjects on measures of speech skills.

Subject	Articulation Errors				Imitative Ability-Placement				Imitative Ability-Acoustic			
Number	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2
106	-	-	-	-	40	51	18.0	18.0	40	51	17.0	17.0
107	-	-	-	-	52	64	22.0	24.0	52	64	20.0	24.0
108	69	82	87	82	69	82	10.0	24.0	69	82	6.0	8.0
108B	82	91	82	81	82	91	24.0	19.0	82	91	8.0	7.0
109	42	54	64	47	-	-	-	-	-	-	-	-
208	43	55	95	96	43	55	4.0	4.0	43	55	2.0	2.0
208B	55	63	96	94	55	63	4.0	4.0	55	63	2.0	2.0
218	60	71	93	90	60	71	5.0	12.0	60	71	5.0	10.0
218B	71	80	90	83	71	80	12.0	16.0	71	80	10.0	7.0
220	60	71	35	13	60	71	20.0	24.0	60	71	19.0	24.0
225	44	53	75	63	-	-	-	-	-	-	-	-
304	-	-	-	-	-	-	-	-	-	-	-	-
304B	-	-	-	-	-	-	-	-	-	-	-	-
509	42	54	78	45	42	54	14.0	18.0	42	54	12.0	18.0
512	61	73	54	50	61	73	22.0	21.0	61	73	17.5	15.0
515	-	-	-	-	-	-	-	-	-	-	-	-
601	38	47	92	93	-	-	-	-	-	-	-	-

APPENDIX B

TABLE 2 (Continued). Scores of control subjects on measures of speech skills.

Subject Number	Articulation Errors				Imitative Ability-Placement				Imitative Ability-Acoustic			
	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2	CA.1	CA.2	test 1	test 2
601B	-	-	-	-	-	-	-	-	-	-	-	-
603	34	46	92	68	34	46	9.0	15.0	34	46	7.5	12.5
603B	46	55	68	80	46	55	15.0	13.0	46	55	12.5	6.0
606	60	73	57	24	60	73	19.0	21.0	60	73	18.0	21.0
606B	73	81	24	36	73	81	21.0	21.0	73	81	21.0	20.5
609	67	75	14	1	67	75	23.0	24.0	67	75	23.0	24.0
610	-	-	-	-	57	65	8.0	10.0	57	65	6.0	6.0
703	42	51	93	85	42	51	9.0	12.0	42	51	3.0	12.0
1002	36	47	95	75	36	47	3.0	9.0	36	47	3.5	9.0
1101	53	65	97	87	65	74	8.0	10.0	65	74	4.0	10.0
1101B	65	74	87	91	-	-	-	-	-	-	-	-
1103	56	67	43	38	56	67	21.0	18.0	67	76	19.5	19.0
1103B	67	76	38	42	67	76	18.0	22.0	56	67	19.0	21.5
1104	-	-	-	-	-	-	-	-	-	-	-	-
1107	52	61	99	93	-	-	-	-	-	-	-	-
1108	44	53	87	80	44	53	14.0	15.0	44	53	13.0	13.0
1110	48	57	73	84	48	57	18.0	14.0	48	57	11.0	7.0

APPENDIX B

TABLE 3. Intelligibility and cleft palate quality ratings for control subjects.

Subject Number		RATINGS Intelligibility			RATINGS Cleft Palate Quality	
	CA 1	CA 2	test 1	test 2	test 1	test 2
108	69	82	4	4	5	4
109	42	54	3	2	2	2
218	60	71	5	5	4	4
220	60	71	3	1	1	1
225	44	53	5	2	2	2
509	42	54	4	3	3	3
512	61	73	3	3	2	2
601	26	38	5	5	3	2
603	34	46	4	4	2	4
606	60	73	2	3	1	2
606B	73	81	2	3	2	3
609	67	75	1	1	2	1
703	30	42	5	4	4	3
1002	36	47	5	5	3	2
1101	53	65	5	5	3	4
1101B	65	74	5	5	4	4
1103	56	67	5	5	2	3
1107	41	52	5	5	2	3
1108	33	44	3	2	2	3
1110	48	57	4	5	4	4

APPENDIX B

TABLE 4. Scores of experimental subjects on measures of language skills.

Subject Number	Language Ability Test CA.1	CA.2	test 1	test 2	Mecham Verbal Lang.Dev.Scale CA.1	CA.2	test 1	test 2	Peabody Picture Voc. Test CA.1	CA.2	test 1	test 2
401	28	40	23	38	24	37	17	27	32	45	25	35
407	41	49	44	50	41	55	52	72	41	49	51	67
410	-	-	-	-	46	58	51	70	46	58	35	58
411	-	-	-	-	38	51	25	30	-	-	-	-
413	34	45	31	42	33	44	23	37	34	45	27	49
414	-	-	-	-	49	61	38	67	49	61	31	48
415	26	39	26	44	23	37	17	46	27	36	25	28
416	36	51	30	48	36	49	29	56	37	49	26	44
418	44	58	34	43	-	-	-	-	44	57	28	37
419	38	52	39	51	38	50	41	72	40	52	55	71
420	43	55	35	47	-	-	-	-	43	55	38	47
421	-	-	-	-	-	-	-	-	34	47	34	41
422	45	57	40	50	47	59	40	60	45	56	29	38
423	-	-	-	-	56	70	46	64	57	68	46	53
424	21	36	12	31	21	35	17	31	-	-	-	-
433	-	-	-	-	18	27	16	20	-	-	-	-
435	21	32	14	29	21	29	16	23	-	-	-	-
437	29	39	31	48	29	39	35	63	30	41	32	55
449	23	31	19	33	22	31	19	41	27	38	26	45
451	36	43	34	46	36	43	37	54	36	43	29	43

APPENDIX B

TABLE 5. Scores of experimental subjects on measures of speech skills.

Subject Number	Articulation Errors CA.1	CA.2	test 1	test 2	Imitative Ability-Placement CA.1	CA.2	test 1	test 2	Imitative Ability-Acoustic CA.1	CA.2	test 1	test 2
401	37	47	97	83	32	46	4.0	11.0	32	46	2.0	6.0
407	42	55	79	31	41	49	12.0	20.0	41	49	12.5	15.0
410	46	58	90	62	46	59	14.5	16.0	46	59	8.0	8.0
411	39	51	54	27	-	-	-	-	-	-	-	-
413	33	44	92	17	-	-	-	-	-	-	-	-
414	49	62	78	38	50	62	12.5	23.0	50	62	7.5	19.0
415	36	49	77	71	31	43	10.5	14.0	31	43	7.5	12.0
416	36	49	87	40	38	49	9.0	22.0	38	49	5.0	18.0
418	42	55	96	74	45	55	6.5	11.0	45	55	5.0	8.0
419	40	53	74	28	40	50	18.0	22.0	40	50	11.5	20.5
420	44	58	92	73	43	52	11.0	12.5	43	52	6.5	8.5
421	35	44	90	84	34	47	12.0	16.0	34	47	6.0	11.0
422	45	59	94	79	47	56	12.0	14.0	47	56	7.0	5.0
423	56	68	43	35	56	68	19.0	22.0	56	68	13.0	18.0
424	-	-	-	-	-	-	-	-	-	-	-	-
433	-	-	-	-	-	-	-	-	-	-	-	-
435	24	35	93	80	24	35	5.0	18.0	24	35	2.0	18.0
437	29	43	69	1	30	43	15.0	24.0	30	43	13.0	24.0
449	24	37	90	37	23	31	8.0	23.0	23	31	7.0	16.0
551	36	43	76	18	36	43	11.0	24.0	36	43	7.0	23.0

APPENDIX B

TABLE 6. Intelligibility and cleft palate quality ratings for experimental subjects.

Subject Number				RATINGS			RATINGS	
				Intelligibility			Cleft Palate Quality	
	CA 1	CA 2	CA 3	test 1	test 2	test 3	test 1	test 2
401	37	47	-	5	4	-	5	5
407	42	55	-	4	2	-	2	1
410	46	58	71	4	4	3	5	4
411	39	51	-	4	2	-	1	1
414	49	62	73	4	3	1	4	3
416	36	49	60	5	4	2	5	2
418	42	55	67	5	4	2	4	4
419	40	53	61	4	3	1	4	3
420	44	58	-	5	5	-	4	4
421	35	44	-	5	4	-	5	4
422	45	59	-	5	4	-	5	4
423	56	68	64	3	1	1	3	2
437	29	43	-	4	1	-	2	1
449	24	37	-	5	2	-	3	1
451	36	43	-	4	1	-	2	1